APPLICATION OF LEAST-SQUARES MESHFREE METHOD TO METAL FORMING ANALYSIS

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The least-squares meshfree method (LSMFM), based on first-order least-squares formulation with moving least-squares approximation, has been shown to be highly robust to integration errors [1, 2]. This means that simply-constructed cells can be effectively used for the purpose of integration. The first-order least-squares formulation is a kind of mixed method and the system matrix is always positive-definite. There is no restriction on the order of shape functions for dual variables. In most cases the equal-order approximation is used for both primal and dual variables, which enhances the accuracy of dual variables in $\boldsymbol{H}^1$–elliptic problems. And also the singularity in the incompressible limit can be easily avoided in LSMFM. These features make the least-squares meshfree method more attractive for solving plastic problems such as metal forming.

In the present paper, the application of LSMFM to elastic and plastic problems is presented. The first-order least-squares formulation to deal with the equilibrium equation and the plastic constitutive equation is studied. The contact formulation for LSMFM is also proposed. It is based on penalty method and the employment of dual variables (stress components) in first-order least-squares formulation facilitates the treatment of frictional constraints. As numerical examples, some metal forming problems are solved using the proposed methodology.

References

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